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ABSTRACT

Following a review of the contributions of computers and managerial science/operations research to the management of libraries, this paper introduces the concept of decision support systems. DSS, a blending of these techniques, can lead to more effective decisions by library managers. A case study of the utilization of a DSS in the budgeting process of a medium sized library illustrates the process. Footnotes provide 23 references. (Author/RAA)

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DECISION SUPPORT SYSTEMS

IN LIBRARIES

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ABSTRACT

In this paper we briefly review the use of computers and management science/operations research in libraries. We then introduce the concept of a Decision Support System (DSS) that can often be viewed as a synthesis of the utilization of computers and quantitative methods to assist librarians in managerial decision making situations. An example of a DSS application for a medium sized library is included.

INTRODUCTION

As a manager, a librarian is responsible for planning, organizing, staffing, coordinating, directing, and controlling the operations of a library. The librarian as a manager is not a role which has historically been accorded the administrator of a library. Murdock and Sherrod's (1) review of the current literature supports the view that librarians who perform management functions see themselves only secondarily as managers. They state that it is interesting that the management literature related to libraries and other information programs that does exist is generally critical, to wit, librarians are poor managers, libraries represent management anachronisms, educational programs in library management are poor, etc. (2).

However, librarians are currently attempting to rectify this situation in several ways. Educational programs are being outlined and developed to meet the needs to train the new librarian as a manager (3), and to assist the library manager in performing as an effective administrator (4). After all, libraries in the economic sense are big business with many libraries having budgets in excess of $1,000,000 (5)(6). Librarians who aspire to the managerial level need more than seniority to promote themselves as effective administrators. As Rohlf succintly states; "Perhaps a bit of advice for 1979 and the future: one desiring to be a library manager should understand how to operate a calculator and what random sample and statistical indicators mean."(7)

In fact, the Council on Library Resources is quick to point out that the need to adapt for library use sound management techniques developed in government, business, academic administration, and elsewhere is made even more critical by the phenomenal growth experienced by libraries in this century. The one hundred members of the Association of Research Libraries recently reported that together they held over 217 million volumes in their collections; at the same time, their combined operating budgets had swelled to over $522 million. (8)

To accomplish their responsibilities in the managerial planning and control activities, librarians must tap all available resources. One of the primary resources is the computer. Many libraries are in the process of developing computer-based information systems to assist the librarian in carrying out his/her responsibilities. Another discipline that can contribute considerably to the effective management of a library is Management Science/Operations Research (MS/OR).

The objective of this paper is to briefly review the contributions of computers and MS/OR to the management of libraries. The major thrust of this paper is to introduce a concept called Decision Support Systems (DSS) that in some sense is a blending of the computer and decision-making analysis techniques from MS/OR that can lead to more effective decisions by managers.

A framework developed by Peter Keen and Scott Morton (9) will be used to illustrate the capabilities of computers and in what types of situations traditional data processing, MS/OR, and DSS are appropriate. Finally, a case study of the utilization of a DSS in the budgeting process for a library is discussed.

COMPUTERS AND MANAGERS IN LIBRARIES

Illustrated in Figure 1, which is adapted from Davis (10) and Gorry (11), is a framework for considering the use of computers at various levels of management. Part of this diagram is based on the work done by Anthony (12).

Anthony developed an excellent framework for structuring and evaluating the managerial planning and control activities of managers in any organization. He specified three categories: strategic planning, management control, and operational control; and argued that each of these levels of managerial activities is sufficiently different in kind to require distinctive planning and control systems. The first of these categories is strategic planning: "The process of deciding on objectives of the organization, on changes in these objectives, and on the politics that are to govern acquisition, use and disposition of resources." (13) This process typically involves senior managers and analysts, often requiring innovation and creativity. The library manager has similiar responsibilities within the context of his organization. As noted by Keen and Morton, the complexity of the problems that arise and the nonroutine manner in which they are handled make it difficult to appraise the quality of the strategic planning process and to define rules for it (14).

At the strategic planning level the strategy is developed with which the organization will attempt to achieve its objectives (15). In a study undertaken by Maurice Marchant on strategic planning in libraries, there are identified eleven catagories of long-range plans

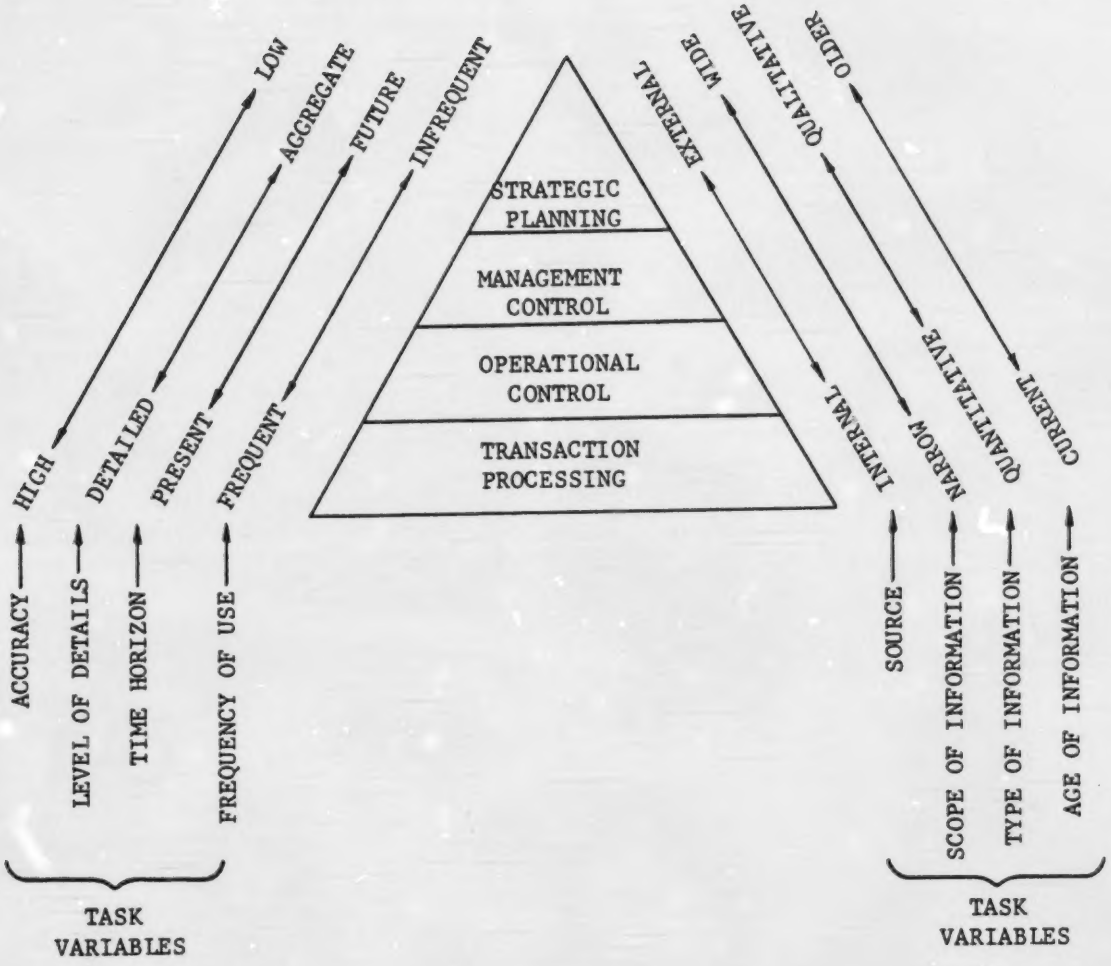

FIGURE 1

MANAGEMENT INFORMATION CHARACTERISTICS

which are or should be a part of this process (16). They are: 1) collection size or growth, 2) scope of the collection, 3) collection media, 4) specific populations served, 5) personnel requirements, 6) capital requirements, 7) equipment utilization, 8) facilities/type, 9) facilities/location, 10) facilities/space requirements, and 11) cooperative activities or service.

The second level is management control. This is the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives. The paramount aim is to assure effective and efficient performance. This stage covers those areas concerned with managers' efforts to measure performance, decide on control actions, formulate new decision rules to be applied by operational personnel, and allocate resources.

Within the context of a library, management control manifests itself in every area from technical services, to reference services, to circulation services, to basic collection development. However, this control in a library setting is difficult for one promary reason: much library work is variable in nature and therefore, difficult to measure (17). Nevertheless, control mechanisms must be established to guarantee that the library's resources are used in an effective and efficient manner. This management control level assures that the organization can provide the materials (book collection, periodical collection, other resources) and services (reference, technical, interlibrary, circulation) to meet the needs of the clientele.

The third category developed by Anthony is operational control and he defines it as the process of assuring that specific tasks are

effectively and efficiently carried out. Operational control is concerned with performing predefined activities. The actual activities identified in the acquisition, cataloging, and circulation of materials are within the scope of operational control. Gratton's example of installing an on-line computer system which will eventually fully integrate circulation control, stock control, and cataloging is a good example of computerization of the operational control stage and the transaction processing stage (18).

The transaction processing systems form the foundation of an information system because they furnish much of the data base required for strategic planning, management control, and operational control. Such items as the order cards, interlibrary loan request forms, circulation control mechanisms, catalog cards, and even employee timesheets constitute the basic input into this foundation.

As can be noted in Figure 1, the characteristics of the information needed at the various stages differ considerably. The information system can be viewed as a support tool that binds together the various elements of a library's organization with one another and with the library's objective of serving its clientele. The system provides data necessary for the daily operations of a library as well as for the formulation, validation, and implementation of models (19). The information required for the strategic planning level is less structured, more summarized, less programmable, and more external than the information needed in the other stages (20). It is precisely because of the structure of this information system and the types of decisions made at the top level that the DSS are becoming such important tools for library managers.

MS/OR APPLICATIONS IN LIBRARIES

Management Science/Operations Research (MS/OR) models have been built for use in libraries. To date, however, their impact has been minimal. In many cases, the models are too technical for librarians to understand or they require assumptions that are too unrealistic. All too often the library literature is filled with examples of the inability of library managers to utilize the powerful analytical tools of simulation and optimization handed out by the OR people. There are several primary reasons that seem to be preventing Operations Research from achieving its potential and fulfilling the expectations of its proponents in library management. Bommer (21) describes these reasons as too much mathematics, too little implementation, too little emphasis upon the process of operations research and too little attention being placed on the pressing strategic problems of library managers.

The usual excuses for these problems fall into one of two categories: the manager is not trained or versed in the mathematical formulations of the models, or the manager is not sympathetic to systematic decision making. There is actually fear in a loss of understanding and reality to "real-world" situations. DeGennero (22) sums it up rather well, "The danger with both kinds of management systems (the quantitative and the behavior or psychological) is that they offer mechanistic formulas for dealing with complex realities and keep us from thinking about and solving our management problems in practical, realistic, and common sense ways." Both sides are never short on words when blaming the other side for failures in using management science techniques.

DSS IN LIBRARIES

Recently, a new concept for utilizing the computers to help managers in their decision making activities has been evolving. This concept is called Decision Support Systems (DSS). In its present state, DSS represents an evolutionary process in the use of computers to provide managers with effective tools for use in their decision-making positions. The emphasis in developing DSS is to examine the actual decision making process and develop a system that can assist managers. The emphasis is not on technical factors such as MS/OR models or on computer technology, but rather on effectiveness. While efficiency is important, greater priority is placed on the effectiveness. In traditional Electronic Data Processing (EDP) applications, the emphasis is on efficiency while MS/OR analysts often develop models with more emphasis on the modeling activities rather than on the problem at hand. A DSS is a blend of EDP and MS/OR.

In the next section, a framework for evaluating the use of computer based information systems along with specifications on where DSS can be particularly useful is given. An example of how a Decision Support System might be used in a library is then examined.

THE UTILIZATION OF INFORMATION SYSTEMS AND DECISION SUPPORT SYSTEMS IN LIBRARIES

The framework presented here is an application to libraries of the framework developed by Keen and Morton (23). This framework is based on the heirarchical decision perspectives developed by Anthony (24)

and on an extension of Simon's (25) work on programmed and nonprogrammed decisions. In order to gain a better understanding of the position of DSS as support systems within a library context, the following framework for library management information systems is presented. The basic model is adapted from Keen (26) and fitted for library applications. Figure 2 shows the two-dimensional framework. The model is examined in three stages; the structured decision stage, the unstructured decision stage, and those of primary concern, the semistructured decisions. It is in the middle level, semistructured, where DSS can be the most effective.

The structured level contains those decisions that do not involve managers. These situations are where managers may have input and, in fact, may have designed the system. However, these are also situations where the decision is well enough understood to have been given to clerks or to have been automated through the computer. Most computer applications of information systems in libraries today are concentrated along the base of the pyramid (Figure 1) and fit neatly into the structured format as described above. The current emphasis on computerization of circulation, acquisition, and cataloging processes in libraries is actually nothing more than an attempt to build a system to assist librarians and clerks in the transaction processing and operational control stages of the structured management information system. It is basically an inventory control problem. This can be readily seen by the examples used to illustrate the structured level.

STRUCTURED MANAGEMENT CONTROL. An example fitting this category is the development and use of optimization criterion to determine the

TYPE OF OPERATIONAL ACTIVITY	OPERATIONAL CONTROL	MANAGEMENT CONTROL	STRATEGIC PLANNING	SUPPORT NEEDED
STRUCTURED	CIRCULATION, INVENTORY CONTROL	OPTIMAL ALLOCATION OF RESOURCES IN LIBRARIES	LOCATION OF A NEW BRANCH LIBRARY	CLERICAL, EDP, OR MIS MODELS
SEMISTRUCTURED	DATA-BASE LITERATURE SEARCHING	SETTING BUDGET FOR LIBRARY SYSTEM	JUSTIFYING RESOURCE INPUTS IN TERMS OF RESOURCE OUTPUTS	DSS
UNSTRUCTURED	SEARCH STRATEGY OF REFERENCE LIBRARIAN	HIRING DEPARTMENT HEADS	SHAPING THE FUTURE OF LIBRARIES	HUMAN INTUITION

FIGURE 2

A FRAMEWORK FOR INFORMATION SYSTEMS IN LIBRARIES

optimal resource allocation within libraries (27). In this example the decisions are facilitated by the use of a linear programming formulation or an optimization model. With increasing demands being placed on a library's shrinking or inflation-depressed budget, it becomes a matter of necessity to determine the appropriate quantity of services to provide for that dollar spent.

STRUCTURED OPERATION CONTROL. An example of a decision in this cell is the circulation - inventory control of materials in the library's holdings (28). It is almost commonplace to observe computers performing in the structured environment of library circulation, acquisitions, and even cataloging. The literature abounds with case histories of successful implementations of computer systems to meet the early demands of librarians and users in the 1950's (29).

STRUCTURED STRATEGIC PLANNING. This cell contains an example illustrating the particular situation where library management preferences and judgements, although not irrelevant, are dominated by the economics of the situation. The location of a new branch library in a system is often determined by various economic factors (30). This data can be used in generalized simulation models currently available which provide a detailed analysis of the economics involved from a service standpoint.

The top level of our framework (Figure 1) contains the unstructured decisions which are either not capable of being structured or that have not yet been examined in depth and so appear to the organization as unstructured. It is here that the manager must take active responsibility

for identifying appropriate direction for library development and for the vigorous, aggressive pursuit of clearly defined institutional and client interests (31). This especially holds true on the strategic planning level.

UNSTRUCTURED OPERATIONAL CONTROL. A prime example of this type of decision is the development of an effective search strategy in response to a particular user's inquiry. Each reference librarian's performance is based on his or her knowledge, experience, and intuition in forming a strategy that will successfully meet the clients' demands. At this time there are still no machines available capable of analyzing a reference question, breaking it into its component parts, searching various data bases, and responding with an acceptable solution. It it still a question to be put to the specialists for future applications(32).

UNSTRUCTURED MANAGEMENT CONTROL. One of the best examples of this type of management activity is the hiring of a new department head. The personnel factors utilized in interviewing, judging, and determining the correct person to hire is based primarily upon the subjective judgement of the manager. An applicant may have met all the requirements and passed the tests; nevertheless, the decision resides with the manager for final analysis and approval. Machines are not capable of performing the ultimate selection process.

UNSTRUCTURED STRATEGIC PLANNING. The problem of how library managers can play a more active role in shaping the future rather than merely attempting to predict and adapt to future needs is an example for this cell (33). It is almost impossible to quantify the subjective and often

unanticipated issues involved in designing and implementing new services and incorporating new technologies to meet the demand of future library users.

The middle level of our framework is our primary concern. As Keen (34) states, these decisions where managerial judgment alone will not be adequate, perhaps because of the size of the problem or the computational complexity and precision needed to solve it. On the other hand, the model or data alone are also inadequate because the solution involves some judgment and subjective analysis. This is where a Decision Support System can bridge the gap between the manager and the problem or decision area.

SEMISTRUCTURED OPERATIONAL CONTROL. There are many operational control decisions that cannot be automated but where computer support in the form of information retrieval, analytic models, or data manipulation may be invaluable. The reference librarian's use of one or more of the more than 160 data bases covering 46,000,000 documents to help solve a client's request is a prime example of a support system in a semistructured environment (35). This is an instance where no automated system can make the reference search from the basic inquiry but where the librarian can quickly and effectively utilize the machine for searching complex data bases, analyzing alternatives, and developing rudimentary search strategies.

SEMISTRUCTURED MANAGEMENT CONTROL. This cell contains the key example used in this paper to illustrate in more detail the use of a DSS in a library framework. The example uses the Interactive Financial Planning System (36) to support the manager's planning

functions. Through this system the machine can explore in detail the implications of inflation rates, trend/cycles, hidden costs, and other sources of probabilities which must be taken into consideration when forming the operating budget. Often these factors are implicit in the manager's own concepts but which he or she finds difficult to formalize.

SEMISTRUCTURED STRATEGIC PLANNING. Again the Interactive Financial Planning System can be used at this level where managerial judgement alone is not adequate and where models or data alone are not sufficient to solve the problem. An example of this situation is where a library manager needs to justify resource inputs in terms of library outputs (37). This is an example of a problem that cannot be automated but where the effects of different financial strategies and assumptions can be reliably extrapolated, given the manager's judgmental inputs.

LIBRARY APPLICATION OF DSS

In order to illustrate the concepts alluded to above in the semistructured management control and strategic planning areas, an operational Decision Support System will be described within a library framework. This DSS is based on EXECUCOM's Interactive Financial Planning Systems (IFPS). The model itself is based upon statistics furnished by the Orange Public Library, Orange, Texas. The data from this medium-size library was used primarily because it bridged the gap between the huge research library and the small special library.

In today's library the key word is accountability. Organizations such as libraries are expected to be accountable for the funds they

spend and the services they provide (38). From the managerial standpoint a person in charge of resources is held responsible for his actions or his behavior (39). The current public awareness of the costs involved in support of their public services places an additional burden on the manager. Galvin (40) succinctly points out that in today's managerial world the hard but inescapable fact is that the library budget derives from and becomes a vehicle for the implementation of institutional plans and the achievement of service goals, rather than being, as was in the past, simply a device for obtaining and dispensing the largest possible piece of the institutional, corporate, or governmental financial pie. This accountability now becomes an issue which must be dealt with directly in the library manager's decision making process. To assist managers in the controlling and planning functions associated with budget preparation, resource allocation, overall accountability, and long-range planning is the DSS. As mentioned above, one such system is the IFPS.

IFPS is a computerized simulation system which enables planning as a natural extension of normal management thought processes. It provides a workable analytical and decision-oriented environment for open and understandable communication (41). Within a financial setting IFPS is designed to make the power of the computer directly available to the non-technician, the library manager. It does this by utilizing an English-like syntax model (problem) formulation and a set of simple commands to solve the model and generate the results. The end result is that IFPS allows the user to focus on the problem not on the solution vehicle (42).

Figure 3 illustrates the summary budget report for a typical library using figures for 1978 thru 1980. An attempt was made to show

ORANGE SPECIAL LIBRARY

1980 SUMMARY BUDGET REPORT

	79BUDGET	79EST	80EST	80PROPSD	78ACTUAL	78%DIFF
TOTAL SALARIES	163864.00	145240.00	146044.01	150304.00	140946.00	-16.26
TOTAL SUPPLIES	9432.00	7897.00	8100.00	8100.00	9068.00	-4.01
TOTAL SERVICES	40372.00	43019.00	46280.00	46280.00	38389.00	-5.17
TOTAL CAPITAL	27451.00	26339.00	26230.00	26230.00	28279.00	2.93
TOTAL BUDGET	241119.00	222495.00	226654.01	230914.00	216682.00	-11.28
TOTAL SALARIES PCT	67.96	65.28	64.43	65.09	65.05	-4.48
TOTAL SERVICES PCT	16.74	19.33	20.42	20.04	17.72	5.49
TOTAL SUPPLIES PCT	3.91	3.55	3.57	3.51	4.18	6.53
TOTAL CAPITAL PCT	11.38	11.84	11.57	11.36	13.05	12.77

	79DIFF	79%DIFF	80DIFF	80%DIFF	81PROJ
TOTAL SALARIES	18624.00	12.82	-4259.99	-2.92	160825.28
TOTAL SUPPLIES	1535.00	19.44	.00	.00	8667.00
TOTAL SERVICES	-2647.00	-6.15	.00	.00	49519.60
TOTAL CAPITAL	1112.00	4.22	.00	.00	28066.10
TOTAL BUDGET	18624.00	8.37	-4259.99	-1.88	247077.98
TOTAL SALARIES PCT	2.68	4.11	-.66	-1.02	69.65
TOTAL SERVICES PCT	-2.59	-13.40	.38	1.84	21.45
TOTAL SUPPLIES PCT	.36	10.21	.07	1.84	3.75
TOTAL CAPITAL PCT	-.45	-3.83	.21	1.84	12.15

78%DIFF = (78ACTUAL - 79BUDGET) / 78ACTUAL
79DIFF = 79BUDGET - 79EST
79%DIFF = (79DIFF / 79EST) * 100
80DIFF = 80EST - 80PROPOSD
80%DIFF = (80DIFF/ 80EST) * 100
81PROJ = 80PROPSD * 7%

FIGURE 3

the versitility and ease of use of this system by extending the original five columns of data to eleven columns, the last six representing statistical manipulations of the data. The eight rows containing the percentage figures for each major budget category are also evidence of the system's capability to perform simple and complex calculations in a matter of seconds.

Figure 4 is a closer look at just one of the four major budget categories. It reveals the items involved under the heading SERVICES, and shows once again some fairly straightforeward data manipulation. Both Figure 3 and 4 are based upon a one-time initial input of the data contained in the actual, estimated, and proposed budget for 1978, 1979, and 1980. The development of the IFPS program took less than two hours and includes all requests for percentages and differences in the budgets between the three years. Within seconds, the computer can complete all calculations and the printer can begin to produce the hardcopy version of the reports. A listing of the IFPS program for the basic model used in Figures 3 and 4 is illustrated in Figure 5.

As a decision support tool for library managers, IFPS makes modifications and/or interrogation of the model very easily, thus changes in assumptions or data take only a matter of minutes from conceptualization to implementation and report generation. For example, the projected budget figures for 1981 in Figures 3 and 4 are based on a 7% inflation factor over 1980's figures. A simple command could raise or lower this inflation factor in order to test its effects on the budget items in times of future uncertainly. Results of the command are almost instanteous with the derivation of new estimates based on the new inputted data.

ORANGE SPECIAL LIBRARY

1980 ITEM BUDGET REPORT

SERVICES	79BUDGET	79EST	80EST	80PROPSD	78ACTUAL	78%DIFF
BUILDING	2114.00	4500.00	3000.00	3000.00	1630.00	-29.69
GROUNDS	400.00	400.00	50.00	50.00	8.00	-4900.00
MACHINES	1500.00	1500.00	1500.00	1500.00	1068.00	-40.45
RENTALS	5698.00	4654.00	5600.00	5600.00	4722.00	-20.67
SPECIAL	400.00	390.00	500.00	500.00	2646.00	84.88
PERIODICALS	5600.00	5600.00	7000.00	7000.00	5264.00	-6.38
LAUNDRY	300.00	65.00	80.00	80.00	244.00	-22.95
TRAVEL	1900.00	1900.00	1000.00	1000.00	1521.00	-24.92
EDUCATION	.00	.00	300.00	300.00	.00	.00
FUEL	3000.00	3000.00	3300.00	3300.00	3092.00	2.98
LIGHTS	16000.00	17500.00	20000.00	20000.00	15221.00	-5.12
COMMUNICATIONS	2860.00	3300.00	3650.00	3650.00	2585.00	-10.64
DUES	600.00	210.00	300.00	300.00	388.00	-54.64
TOTAL SERVICES	40372.00	43019.00	46280.00	46280.00	38389.00	-5.17
TOTAL SERVICES PCT	16.74	19.33	20.42	20.04	17.72	5.49

SERVICES	79DIFF	79%DIFF	80DIFF	80%DIFF	81PROJ
BUILDING	-2386.00	-53.02	.00	.00	3210.00
GROUNDS	.00	.00	.00	.00	53.50
MACHINES	.00	.00	.00	.00	1605.00
RENTALS	1044.00	22.43	.00	.00	5992.00
SPECIAL	10.00	2.56	.00	.00	535.00
PERIODICALS	.00	.00	.00	.00	7490.00
LAUNDRY	235.00	361.54	.00	.00	85.60
TRAVEL	.00	.00	.00	.00	1070.00
EDUCATION	.00	.00	.00	.00	321.00
FUEL	.00	.00	.00	.00	3531.00
LIGHTS	-1500.00	-8.57	.00	.00	21400.00
COMMUNICATIONS	-440.00	-13.33	.00	.00	3905.50
DUES	390.00	185.71	.00	.00	321.00
TOTAL SERVICES	-2647.00	-6.15	.00	.00	49519.60
TOTAL SERVICES PCT	-2.59	-13.40	.38	1.84	21.45

78%DIFF = (78ACTUAL - 79BUDGET) / 78ACTUAL
79DIFF = 79BUDGET - 79EST
79%DIFF = (79DIFF / 79EST) * 100
80DIFF = 80EST - 80PROPOSD
80%DIFF = (80DIFF/ 80EST) * 100
81PROJ = 80PROPSD * 7%

FIGURE 4

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MODEL ORANGE  VERSION OF  12/18/79  14:29
10 ◆ ORANGE SPECIAL LIBRARY
15 ◆   BUDGET REPORT
20 ◆
21◆
22◆ 78%DIFF = (78ACTUAL - 79BUDGET) / 78ACTUAL
23◆ 79DIFF = 79BUDGET - 79EST
24◆ 79%DIFF = (79DIFF / 79EST) ◆ 100
25◆ 80DIFF = 80EST - 80PROPOSD
26◆ 80%DIFF = (80DIFF/ 80EST) ◆ 100
27◆ 81PROJ = 80PROPSD ◆ 7%
28◆
29◆
30 COLUMNS 79BUDGET,79EST,80EST,80PROPSD,78ACTUAL,78%DIFF,79DIFF'
35 79%DIFF,80DIFF,80%DIFF,81PROJ
40 ◆PERSONAL SERVICES
45 SALARIES=134302,116740,146044,138215,117013
50 TEMP HELP=0,930,0,0,0
55 CETA HELP = 13376,17730,.01,12089,17196
60 AR HELP=16186,9740,0,0,6701
65 OVERTIME=0,100,0,0,36
70 TOTAL SALARIES=SALARIES+TEMP HELP+CETA HELP+AR HELP+OVERTIME
75 ◆SUPPLIES
80 OFFICE=5882,5882,5800,5800,5794
85 FOOD=100,100,100,100,69
90 TOOLS=400,400,400,400,387
95 CLEANING=900,900,1200,1200,761
100 EDUCATIONAL=900,500,600,600,807
105 PRINTING=1250,115,0,0,1250
110 TOTAL SUPPLIES=OFFICE+FOOD+TOOLS+CLEANING+EDUCATIONAL+PRINTING
115 ◆SERVICES
120 BUILDING=2114,4500,3000,3000,1630
125 GROUNDS=400,400,50,50,8
130 MACHINES=1500,1500,1500,1500,1068
135 RENTALS=5698,4654,5600,5600,4722
140 SPECIAL=400,390,500,500,2646
145 PERIODICALS=5600,5600,7000,7000,5264
150 LAUNDRY=300,65,80,80,244
155 TRAVEL=1900,1900,1000,1000,1521
160 EDUCATION=0,0,300,300,0
165 FUEL=3000,3000,3300,3300,3092
170 LIGHTS=16000,17500,20000,20000,15221
175 COMMUNICATIONS=2860,3300,3650,3650,2585
180 DUES=600,210,300,300,388
185 TOTAL SERVICES=SUM(BUILDING THRU DUES)
190 ◆CAPITAL OUTLAY
195 FURNITURE=1744,632,0,0,3268
200 EQUIPMENT=707,707,1230,1230,11
205 BOOKS=25000,25000,25000,25000,25000
210 TOTAL CAPITAL=FURNITURE+EQUIPMENT+BOOKS
215 ◆
220 ◆TOTAL BUDGET COSTS
225 ◆
230 TOTAL BUDGET=TOTAL SALARIES+TOTAL SUPPLIES+TOTAL SERVICES+TOTAL CAPITAL
235 ◆
240 ◆ITEM PERCENTAGES
255 TOTAL SALARIES PCT = TOTAL SALARIES/TOTAL BUDGET◆100
265 TOTAL SERVICES PCT = TOTAL SERVICES/TOTAL BUDGET◆100
270 TOTAL SUPPLIES PCT = TOTAL SUPPLIES/TOTAL BUDGET◆100
275 TOTAL CAPITAL PCT = TOTAL CAPITAL/TOTAL BUDGET◆100
280 COLUMN 6 = ((COLUMN 5 - COLUMN 1)/COLUMN 5) ◆ 100
285 COLUMN 7 = COLUMN 1 - COLUMN 2
290 COLUMN 8 = (COLUMN 7/COLUMN 2)◆100
295 COLUMN 9 = COLUMN 3 - COLUMN 4
300 COLUMN 10 = (COLUMN 9/COLUMN 3)◆100
305 COLUMN 11 = (COLUMN 4) ◆ 1.07
END OF MODEL
```

FIGURE 5

Some typical IFPS applications for library managers include operating budgets, cash budgets (cash flow projections), lease or purchase decisions, various strategic planning cases, library expansion analysis, project selection, capital budgeting, risk analysis, and discounted cash flow analysis. Highlights of this particular system can reveal the general usefulness of Decision Support Systems in the semistructured environment of the library manager:

1) A special "what if" capability for testing alternatives and sensitivity analysis is available for the manager. For example, what happens to the budget totals and percentages if utility bills increase dramatically because of energy embargos by foreign countries in the next 18 months?

2) Consolidation features are available for budgeting applications. If a library system has several branches, each unit could produce a budget as illustrated in Figures 3 and 4. They could then be consolidated into one master budget by the use of a simple command to the computer.

3) As stated previously, the problem to be solved is formulated in English-like statements. The manager can directly use the system without going through an intermediary language. Our example using the statistics from the Orange Public Library took less than 70 statements or sentences and did not require a knowledge of COBOL, FORTRAN, or other languages. (Figure 5)

4) Built-in financial analysis capabilities include present value, internal rate of return, depreciation, and amortization. Although not illustrated in this paper, simple commands produce these results.

5) The user has the choice of editing his own reports and of obtaining either complete reports or just the values for selected items. Both Figures 3 and 4 are edited reports based upon the same model.

IFPS is one example of several DSS available (43). Nevertheless, it is capable of reducing a complex budgeting problem into a simple solution by a computer. Koenig (44) illustrates a very simple problem in present value calculations to determine the acceptability of a new computer-assisted cataloging system. Using a DSS, that type of problem solving becomes routine and versatile. By plugging in the figures the problem is reduced to an understandable analytical step in the decision making process. It does not become the problem. Rather, the information gained from the data manipulation supports the manager who must make that decision.

CONCLUSION

This paper has attempted to accomplish several things. It began by examining the role of the library manager and emphasizing the need for decision support tools to aid these managers in the top levels of strategic planning and management control. It then provided a view of the information network of the decision making process within an organizational framework. Management Science/Operations Research models in libraries were briefly discussed next. However, out of this discussion there emerges the major thrust for this paper, Decision Support Systems.

This information was then applied to a library framework to illustrate two major points. First, it placed the role of the DSS within the decision making areas of the library into a more formal perspective. And second, it revealed how various problems within modern libraries fit into the framework for an information system. Specific examples were used to illustrate each typology. Finally, an example of an

operational DSS was described. Applications of this model to a particular library are independent of constraining situational factors. It has universal appeal in its ability to bridge that gap between management science and management.

A final word on DSS. Although libraries appear to be inexorably bound to the transaction processing level in the management information system through their current computerization attempts, the times are swiftly changing. It is not prophetic to say that library managers will change. It is already happening. Operations research has been applied to the library's problems for over a decade (45). Library schools are now reaching beyond the traditional subject areas to prepare tomorrow's librarians for the roles they will assume as managers of libraries (46). Systems are being designed, tested, developed, and implemented to provide for more than just processing day-to-day transactions on the clerical level (47).

In the continual evolution of man's use of machines, it appears that DSS are the next step. A half-step really, bridging that gap between the analytical and the heuristic. It places the powerful tools of the computer specialist in the hands of the manager not as a recall device, but as a support system. Future applications can open new doors for librarians who cross into the world of true library management.

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